BC hydro

ELECTRIC SYSTEM DEVELOPMENT PLAN

For the ten-year period
1 April 1989 to 31 March 1999

May 1989

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B.C. HYDRO

ELECTRIC SYSTEM DEVELOPMENT PLAN
FOR THE 10-YEAR PERIOD
1 APRIL 1989 TO 31 MARCH 1999

System Planning Division
System Development

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ELECTRIC SYSTEM DEVELOPMENT PLAN
FOR THE 10-YEAR PERIOD
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EXECUTIVE SUMMARY

This report describes B. C. Hydro's 10-year capital plan for developing and reinforcing the electric transmission system to deliver electricity to present and future customers within prescribed standards of reliability and cost. The plan provides a summary of the proposed capital program for B. C. Hydro's electric transmission, station, protection, control and communication systems. The diesel program for the non-integrated system is also provided. The generation plan for the integrated electric system is covered in the report, Twenty-Year Resource Plan.

B. C. Hydro's resource strategy with emphasis on purchases and coordination agreements to provide for future energy requirements will require a strong and reliable transmission system to deliver this energy to its customers. A second Skeena to Kitimat 287 kV line and a third Williston to Kelly Lake 500 kV line in 1994 are required to transmit purchased power from Alcan's Kemano Completion Project to new loads.

The integrated system probable demand is estimated to increase by 1760 MW or 23 percent over the next 10 years. Various facilities will be required to meet this load growth. The fourth Burrard Thermal generation unit is to be converted to synchronous condenser operation in 1989. Series capacitors at American Creek are planned for the 500 kV transmission lines from Nicola to Ingledow and Meridian in 1990. A phase shifting transformer is planned at Nelway Substation in 1990 to control unscheduled power flow (loop flow) thus reducing line losses and releasing transmission capacity to serve new loads. The Peace 500 kV transmission lines are to be upgraded between 1989 and 1991 to ensure that adequate conductor-to-ground clearances are maintained during heavy loading. A 500 kV transmission line is planned from Kelly Lake to Cheekye in 1995.

Two 230 kV transmission lines to the United States are planned: Aldergrove to Bellingham (Puget Sound Power and Light) in 1992, and Selkirk Substation to Spokane (Washington Water Power) in 1995.

Area transmission reinforcements are required to serve new loads. In the Lower Mainland, a 230 kV line extension to Howe Sound Pulp and Paper is scheduled in 1989, uprating of four 69 kV circuits in 1989 and 1990; a 230 kV loop into Horne Payne Substation is planned for 1990; a 500 kV loop into Aldergrove Substation is planned for 1992; a 230 kV overhead line from Ingledow to Kidd #2 in 1994 and a 230 kV overhead and cable circuit from Cambie Road to Mainwaring in 1996. On Vancouver Island, various 138 and 230 kV transmission lines are planned: between Dunsmuir and Gold River in 1989 to serve a CIP load; supply to Lantzville distribution substation in 1990; rebuilding of the Goward to George Tripp line in 1995; a Dunsmuir to Port Alberni line in 1997; and a supply to Harewood Substation in 1998. In the South Interior 138 kV taps are scheduled to supply Trans Mountain Pipeline pumping stations at Albreda

and Darfield in 1989, a 60 kV line is planned from Spences Bridge to Lytton and uprating a 25 kV line from Lytton to Boston Bar to 60 kV operation in 1995; 230 kV lines are planned from Merritt to Highland in 1997; Alexander Creek to Natal in 1998; Cranbrook to Invermere and Golden in 1998; Nicola to Merritt in 1998; as well as a 500 kV loop into Alexander Creek Substation in 1998.

In the North Coast a 138 kV line extension from Aiyansh to integrate Stewart is underway for service in 1989. Various other 138 kV and 230 kV lines are planned in the North Coast and Central Interior towards the end of the 10-year period.

The Stations program includes 137 discrete projects, 53 associated with the transmission additions, 3 at generating stations, 46 for distribution requirements and 26 miscellaneous items.

The Protection program includes items for the above transmission and station additions as well as extensive upgrading and replacement programs. Some examples are replacing electromechanical relays and fault recorders; upgrade of series capacitor station power supplies; automation at John Hart and Bridge River generating stations; and upgrade of existing protection and control systems at major generating stations.

The System Control and Communications program includes implementation of a modern Energy Management System, replacement of obsolete control facilities at various control centres; microwave radio to American Creek Capacitor Station, Alexander Creek, and Kitimat substations; and installation of various power line carrier facilities.

The proposed capital program for the 10 years (1 April 1989 to 31 March 1999) will amount to $5,447 million including allowances for inflation, corporate overhead and interest during construction.

Implementation of this plan will achieve the corporate mission and objective to support the economic development of British Columbia through the efficient supply of electricity and to provide superior customer service.

1.0 INTRODUCTION

The Electric System Development Plan for the 10-year period 1 April 1989 to 31 March 1999 defines the action and capital expenditure necessary for developing and improving the electric system to meet present and future customer requirements. Implementation of the plan will support B. C. Hydro's mission and its objectives to support the economic development of British Columbia through the efficient supply of electricity and to provide superior customer service.

This Plan provides a summary of the proposed capital program for B. C. Hydro's electric transmission, substation, protection, control and communications systems over the next 10-year period. Prepared by the System Planning Division, the Plan describes the continuing systematic expansion of the electric system, utilizing technical criteria outlined in Appendix A. The Plan is modified annually in response to revisions in economic and load forecasts. The proposed upgrades and improvements are necessary for the safe, reliable and efficient operation of the electric system.

The generation resource plan for the integrated electric system is covered in more detail in a companion report, Twenty-Year Resource Plan, prepared by Corporate Affairs.

Related electric distribution system plans, prepared by Customer Services, are coordinated with but not included in the Electric System Development Plan.

2.0 LOAD FORECAST

Unlike generation planning techniques, area transmission and sub-station planning is based on forecasts of specific area loads, rather than on a range of total system demand projections. To obtain specific area forecasts, the forecast probable demand from the Electric Gross Load Requirements Forecast, is distributed over the various regions of the electrical system, and assigned to specific stations in relation to the anticipated growths in those areas. The resultant forecast for each station is presented in Appendix B. These station forecasts are then used to determine the requirements for additions to stations and to area transmission lines feeding those stations.

The bulk transmission system is planned using the specific area load forecast scaled to agree with the probable integrated system peak load with adjustments for demand side management and interruptible marketing loads as shown in Table 1.

The plans derived from load forecasts must also have some flexibility to respond to changes in load, resource options, Independent Power Producer proposals, or increases in firm exports.

3.0 GENERATION

(a) Integrated System

The recommended sequence of resource additions (based on the recommended Twenty-Year Resource Plan) is presented in Table 2 and is used to determine the associated transmission requirements. Keenleyside Generating Station, planned to be built for service in 1998, is the only major generation addition planned for service in the 10-year program although Peace Site C is planned in the eleventh year, 1999.

Following are brief summaries of the new resources that are planned over the next 10 or more years to provide electrical power for use by B. C. Hydro's customers. This schedule provides sufficient resources to meet the Probable forecast with the capability of speeding up or delaying some developments if actual load growth is above or below the Probable.

Power Smart Programs - These are on-going, customer-oriented, energy-efficient programs directed towards reducing future load growth by encouraging more efficient use of energy. This benefits both the customer (through lower electricity bills) and B. C. Hydro (by delaying commitment to new generating facilities, thereby lowering financial and environmental impacts).

Resource Smart Programs - These on-going programs are intended to make existing generation facilities more efficient and thereby obtain significant additional energy from the B. C. Hydro system and allow postponement of new generation developments.

Coordination and Purchases

Inter-Utility System Coordination

B. C. Hydro expects to implement a coordination agreement with the Bonneville Power Administration by the fall of 1989 and is discussing the possibilities for coordination with Alberta utilities.

Alcan Purchase

B. C. Hydro has agreements in principle with Alcan for coordinated reservoir operation for 50 years and for the purchase of 2500 GW·h per year for 20 years, both beginning in early 1995 when Alcan's Kemano project will be completed.

These coordination and purchase agreements offer B. C. Hydro a potentially attractive combination of operating flexibility and fairly priced energy.

Independent Power Producers - In the future, B. C. Hydro will be relying more on independent power producers and increased self-generation as a way of minimizing the cost of electrical service. Cost-effective independent power production can contribute a portion of B. C. Hydro's supply requirements and allow deferral of more costly projects.

Downstream Benefits Arising from the Columbia River Treaty - The Canadian entitlement to downstream benefits resulting from the operation of water storage in the reservoirs at the existing Duncan, Keenleyside and Mica dams under the Columbia River Treaty was sold to the United States for a period of 30 years. Those downstream benefits will revert to British Columbia, starting in 1998/99.

Keenleyside Generation - Keenleyside is an existing storage dam on the Columbia River. Turbines will be installed in the dam to utilize the energy of the water behind the dam. The scheduled in-service date is 1998 with a generation output capacity of 240 MW (project size currently under review).

Peace Site C - Site C, near Fort St. John, will be the third generating station on the Peace River (G. M. Shrum and Peace Canyon generating stations near Hudson's Hope are already producing power). It is now planned as a 900 MW development with first power production starting in 1999.

Additional Resources Beyond 2000 - The selection of the next resource additions to the system after Site C has not been made. The choice will be affected by public input, actual load growth and load forecasts over the next few years, the return or sale of the Columbia River downstream benefits, and by the effectiveness of the programs described above.

(b) Diesel Program (Non Integrated System)

A diesel generating unit addition is scheduled for Fort Nelson in 1992, subject to responses for IPP proposals. Stewart is scheduled to be integrated in 1989 via a 138 kV transmission extension from Aiyansh to serve Stewart, Hyder and Westmin Mines. Kitkatla is scheduled to be integrated via a distribution overhead and submarine cable extension in 1989.

Improvements to fuel system handling facilities are scheduled for Masset and Telegraph Creek in 1989, and at Atlin, Ah-Sin-Heek, Anahim Lake, and various other plants in subsequent years of the Plan to improve efficiency, reliability and security of operation.

4.0 TRANSMISSION

The annual planning review of existing transmission facilities and required additions to serve increased load in the various regions of B. C. is conducted in accordance with approved technical criteria (Appendix A). New facilities resulting from the review in late 1988 are included in the Plan, as follows:

(a) Capital Program

(i) Bulk Supply System

The bulk supply consists primarily of the 500 kV transmission lines and substations shown in Fig. 1. In 1990, series capacitors are required at American Creek to compensate the 500 kV transmission lines from Nicola to Ingledow and Meridian. From now until 1991, the Peace 500 kV transmission lines will be surveyed and upgraded where necessary to increase their thermal capability and ensure that adequate conductor to ground clearances are maintained. These actions will increase the transfer capability of the Interior to Lower Mainland transmission network and are required to serve the continued load growth in the Lower Mainland and Vancouver Island regions.

Another concern on the bulk transmission system is the effect of inadvertent power flow through the B. C. Hydro system caused by generation scheduling in the U.S.A. and Canada (generally referred to as loop flow). It can restrict power transfers within B. C. Hydro as well as with the U.S.A. and Alberta, and it tends to increase the transmission losses in the B. C. Hydro system. To alleviate this loop flow problem, a phase-shifting transformer will be added to the Nelway-Boundary 230 kV U.S. intertie at Nelway Substation in 1990.

In 1992, a 230 kV intertie with Puget Sound Power and Light is planned, consisting of two transmission circuits (40 km double circuit and/or single circuit lines with only 4 km in B. C.) from a new substation near Aldergrove to Bellingham, Washington. Construction is subject to agreement with PSP&L, as well as approvals from U.S. and Canadian government agencies.

In 1993 a static var compensator (SVC) will be installed at Malaspina Substation to provide voltage support to the transmission system. This will allow increased transfers of power to be made to new loads in Vancouver Island and the Lower Mainland.

In 1994, a third Williston-Kelly Lake 500 kV line (330 km) and a second Skeena-Kitimat 287 kV line (50 km) will be required to provide firm transmission capability for power purchased from Alcan's Kemano Completion Project. The addition of the Williston-Kelly Lake line will also accommodate power from Site C scheduled for service in 1999.

A second Kelly Lake-Cheekye 500 kV transmission line (193 km) is scheduled for service in 1995 to increase the transfer capacity of the Interior to Lower Mainland transmission network to serve continued load growth in the Lower Mainland and Vancouver Island regions. It is scheduled at its earliest in-service date of 1995 and will give the system some flexibility to meet higher than expected demands. Should these higher loads not materialize, the line will be delayed.

In 1995, a double circuit 230 kV line (200 km approximately 10 km in B. C.) from Selkirk Substation to Spokane, Washington will interconnect B. C. Hydro directly with the Washington Water Power system (WWP). Construction is subject to agreement with WWP, as well as approvals from U.S. and Canadian government agencies.

In 1997, an SVC is required at Kelly Lake to increase the transfer capacity of the transmission system into the Lower Mainland to serve new load.

In 1998, a second Nicola-Meridian 500 kV line (250 km) will be required to further increase the transfer capability of the Interior to Lower Mainland transmission network and to serve the continued load growth in the Lower Mainland and Vancouver Island regions.

In 1998, a 230 kV transmission line will be required between Keenleyside Generating Station and Selkirk Substation to integrate Keenleyside into the system. Sufficient right-of-way is also to be acquired for a future 230 kV loop into Murphy Creek Generating Station.

(ii) Bulk Supply System Reliability

This past year reliability of the bulk transmission system remained acceptable even during periods of high stress. This year's peak load of 7485 MW (2 February 1989) exceeded the forecast peak by 225 MW, and was coincident with an export of 275 MW to the U.S., 275 MW to West Kootenay Power & Light and an import of 179 MW from Alcan. Low production from Lower Mainland and Vancouver Island generation and an outage of half of the capacitor bank at

Creekside further stressed the Interior to Lower Mainland transmission network. Three extra units at Burrard were run lightly loaded to provide the necessary reactive power reserves required to maintain system voltages in case of another line outage. Some operating restrictions during heavy loads have been necessary because of voltage stability and line loading limits.

The ability to serve peak loads with one major transmission element out-of-service is a growing concern. With one line out-of-service, it is necessary to purchase power from the U.S.A and either run Burrard Thermal or be prepared to shed loads for adequate system security should a second outage occur.

Generation shedding is still necessary to maintain transient stability for certain single line outages of Peace and Mica 500 kV transmission lines. While this practice does not meet B. C. Hydro's criteria, it has so far not significantly reduced the reliability of the system, or resulted in any complaints from U.S. utilities, but would certainly do so if the practice became widespread throughout B. C. Hydro's electrical system.

The North Coast System is served by one 500 kV transmission line, and is thus subject to loss of supply if any of the line sections trips out. With the expansion of the Kemano generating station and purchase of the power by B. C. Hydro, the security of supply to this area will be improved significantly. Scheduling the output of the Kemano plant will have to consider conflicting needs: running the plant at least as high as the local loads to avoid dropping load following 500 kV line outages versus running the plant at lower output to better maintain reservoir levels to achieve coordination benefits.

The loop flow problem described earlier, can overload the Selkirk - Nelway and Nelway - Boundary 230 kV transmission lines during certain operating conditions. The current practice is to either restrict the magnitude of B. C. Hydro's interchanges with the U.S. Pacific Northwest and TransAlta, or open one of the above lines in the loop path during such interchanges. Opening a line reduces the security to local loads and generation and is considered to be a temporary solution only, until the phase shifting transformer planned for Nelway Substation in 1990 is installed.

Operating restrictions during high ambient temperatures are necessary on the Peace to Lower Mainland 500 kV lines

because of thermal line limits (conductor clearances) until these lines are upgraded.

Operating staff occasionally have to remove lines from service during light load periods to avoid high voltages indicating that control of system voltages is becoming more difficult to achieve. The Burrard Thermal synchronous condensers will help in this regard.

(iii) Lower Mainland Supply

The Lower Mainland is supplied from three major 500 kV receiving stations, Ingledow, Meridian and Malaspina, which serve a network of lower voltage transmission lines and substations in the Vancouver area, the Fraser Valley, and the Sechelt Peninsula. An addition to the 230 kV system on the Sechelt Peninsula is underway to serve an industrial load increase at Howe Sound Pulp in 1989. To reinforce the Vancouver and Fraser Valley supply networks, a 230 kV overhead and cable loop is planned from an existing transmission circuit into Horne Payne Substation in 1990, a 500 kV overhead loop into Aldergrove in 1992, and a new 230 kV overhead circuit from Ingledow to Kidd #2 in 1994.

Cuts and ties of the 230 kV cable circuits at Mainwaring are planned in 1996 to redistribute loadings on the circuits. Also planned in 1996 is a Cambie Road-Mainwaring 230 kV cable circuit to increase the transmission capacity into the South Vancouver area.

(iv) Vancouver Island Supply

The primary power supply to Vancouver Island is from the Mainland over submarine cable circuits ties. The ties to Vancouver Island consist of two 500 kV circuits, two 138 kV circuits and a 260/280 kV dc transmission system. Based on present load forecasts, this supply from the mainland, together with the local generation on Vancouver Island, will be capable of supplying Vancouver Island beyond the 10-year period.

However, some upgrading of existing transmission and some transmission additions will be required during the 10-year period to meet the forecast load growth on Vancouver Island. These additions include: a 230 kV line from Dunsmuir to Gold River to serve CIP load at Gold River in 1989; a 138 kV transmission loop into the planned Lantzville distribution station near Nanaimo in 1990; the rebuilding of the Goward to George Tripp 138 kV transmission line in 1995 to allow for the planned conversion to 230 kV operation

in the future; a third 138 kV transmission line (designed for ultimate 230 kV operation) from Dunsmuir to Port Alberni Substation in 1997; and a new 138 kV (230 kV design) circuit to strengthen the supply to Harewood Substation in 1998.

The single 138 kV transmission system line from Ladore to Port Hardy, represents a very weak supply to customers at the northern end of Vancouver Island. Stability of the northern system is marginal and voltages can reach low levels under some operating conditions. The security of supply to this area will improve on completion of the Dunsmuir to Gold River 230 kV line in 1989.

(v) South Interior Supply

The South Interior is supplied by a complex high-voltage network from Kelly Lake, Nicola, Ashton Creek, Selkirk and Cranbrook Substations. Major additions are scheduled during the 10-year period as well as some minor upgrading. The work includes: a 69 kV transmission line from Spences Bridge to Lytton and uprating a 25 kV line from Lytton to Boston Bar to 69 kV operation in 1995; a 230 kV transmission line from Craigmont tap to Merritt (138 kV operation) in 1997; 230 kV transmission lines from Alexander Creek to Natal, from Cranbrook to Invermere and Golden, from Nicola to Merritt (138 kV operated); and a 500 kV loop into Alexander Creek, all in 1998. These additions are necessary to provide increased transmission capacity to serve growing industrial and district loads.

There is considerable uncertainty in transmission requirements to serve major industrial loads in the Highland Valley and the East Kootenays. These loads may increase rapidly or conversely could disappear, depending on business conditions.

(vi) North Coast and Central Interior Supply

The North Coast and Central Interior are primarily supplied from Williston Substation with some backup from Alcan generation to Minette Substation.

Local area transmission plans in the 10-year forecast include a second 138 kV line from Telkwa to Smithers in 1993 to provide firm supply to Smithers, and a 69 kV line from Williston to Chief Lake in 1996 to provide firm supply to Chief Lake and to the new Ospika Distribution Substation in Prince George.

Engineering is underway for a 138 kV line extension from Aiyansh to Stewart to serve Stewart, Hyder customers and the new Westmin Mine, and for a short 287 kV line from Minette to the Eurocan mill expansion, both for service in 1989.

(b) Work Not Identified in the Capital Program

Transmission line extensions and related station facilities required to serve new industrial customers, which are included in the load forecast under the category "Future Industrial Load" have not been included in this Plan as they are contingent on customer commitments. Facilities required to integrate domestic and export Independent Power Producers into the B. C. Hydro system are not included in this plan.

5.0 STATIONS

(a) Capital Program

The stations program required to serve the various regions of B. C., identifies all significant capital additions required through the 10-year period and all smaller additions, such as specific feeder positions, in the first five years. The 1989-1999 capital program includes 137 discrete projects, consisting of 53 associated with the transmission and bulk supply system, 3 at generating stations, 46 to provide for additional distribution load requirements and 26 for other improvements and miscellaneous items. Forty-two of these station projects need to be initiated in 1989.

(b) Significant Additions

Significant additions in the first three years include:

- Installation of two 150 MV·A 230/138 kV transformers at Gold River (1989).
- Stewart 138/25 kV transformation (1989).
- Port Alberni 138/12 kV transformer and switching additions (1989).
- Kidd #2 230/69 kV transformer replacements (1989).
- Arnott - new 230/25 kV Substation (1989).
- A third 500/230 kV transformer at Selkirk (1990) (under review).
- A new Lantzville 138/25 kV Substation (1990).

- A new 138 kV switchyard at John Hart G. S. (1991).
- A new 500/230 kV substation at Aldergrove in 1992.
- A 300 Mvar static var compensator (SVC) at Malaspina Substation (1993).

6.0 PROTECTION

In addition to the system protection activity resulting from the capital programs listed in Sections 4 and 5, several protection upgrading/replacement programs are scheduled over the next 3 to 4 years:

1. Major transmission line protection upgrading program to replace aging electromechanical relays with modern solid state/digital/ protection systems.
2. System fault recorder replacement program to replace aging magnetic drum fault recorders with digital fault recorder systems.
3. Upgrade of existing series capacitor station platform power supplies.
4. Upgrade of existing protection and control systems at major generating stations.
5. Protection improvements associated with Bridge River generating station upgrade and conversion to automatic operation.
6. Protection improvements associated with John Hart generating station upgrade and conversion to automatic operation.

7.0 SYSTEM CONTROL & COMMUNICATIONS

(a) System Description

The System Control Centre at Burnaby Mountain provides automatic control of generation to meet load requirements and to allow interconnected operation with other utilities, and is equipped to provide supervision and remote control of the 500 kV transmission grid. Six area control centres have supervision and remote control facilities to operate the electric system in their area, including generation, transmission, subtransmission and distribution. The communication systems, consisting of microwave radio, VHF/UHF radio, power line carrier, fibre optics, and leased wire line facilities, provide the necessary channels for protective relaying, control systems, mobile radio systems, telephone systems, and data systems required for

protection, control and communication in the electric power system.

The strength of B. C. Hydro's control and communication facilities lie in their high reliability and versatility. An ongoing concern is that rapid advances in high-technology continue to reduce the expected lifetime of installed electronic systems due to lack of spare parts and replacements.

(b) Capital Program

(i) Control

A major program to redevelop the System Control Centre on Burnaby Mountain, the Vancouver Island Control Centre at Duncan, and the South Interior Control Centre at Vernon is planned over the next 5 years. This program is required to meet changes in the operational requirements of the electric power system, to overcome technical obsolescence, and to address the current critical inability to expand the existing facilities to meet today's requirements.

A major element of this program will be the establishment of a modern Energy Management System (EMS) featuring advanced applications software to meet the need for observability, control and analysis. An improved man-machine interface will be an integral part of the system to enable the power system dispatcher to meet the demanding operating challenges. The EMS will also provide for the increased efficiency demanded of the system today while maintaining safe, secure and reliable operation.

(ii) Microwave Radio

Microwave radio system extensions to Alexander Creek and Kitimat are included in the plan. In addition, microwave radio extensions are being considered for the new Aldergrove-Bellingham circuits and Selkirk-Spokane circuits.

The Telecommunications Strategic Plan, which provides for high speed data communications services and a digital backbone network interconnecting the head office with regional offices and other selected locations, is based on B. C. Hydro's business objectives and directions and is aimed at effectively developing B. C. Hydro's telecommunication facilities, taking full advantage of the new digital transmission technologies and meeting increasing service demands. Over the next 5 years, significant traffic growth on B. C. Hydro's telecommunications network is anticipated as existing services are expanded and new business and customer service systems are introduced. The

new digital facilities will allow for increased data transmission and support new services as required.

The decreasing cost of digital radio, its increasing reliability, its direct applicability to data transmission, and the pressure from regulatory agencies to adopt digital radio transmission make this project timely. Concurrently, analogue radio is becoming more difficult to obtain, and the price is increasing.

There is a continuing requirement to replace older microwave systems, either because of Department of Communications regulations which redefine B. C. Hydro's operating frequencies, or because the equipment is obsolete and is becoming difficult to maintain. This includes the microwave systems, on Vancouver Island, in part of the Mica-Kootenay region, in the Skeena area, and at Huntingdon.

(iii) Power Line Carrier

Power line carrier facilities are now being provided on the new G. M. Shrum-Taylor circuit and will be provided for the new Gold River-Dunsmuir circuit. Power line carrier will also be considered for the planned Lantzville Substation.

(iv) VHF/UHF Radio

Conversion of VHF/UHF remote radio repeater sites from battery operation to solar power to improve reliability and reduce costs will continue. Upgrading of repeater, mobile, and base stations equipment to meet new Department of Communications standards and regulations will continue as necessary.

(v) Fibre-Optics

Fibre-optic transmission is rapidly becoming a mature technology for broad band high speed communications, particularly for digital networks. Consequently the fibre and the associated handling end devices are increasingly available at continually decreasing costs.

Fibre-optics may become a viable alternative to microwave radio within the time span of the capital program, particularly in the urban areas.

8.0 CAPITAL EXPENDITURES

The proposed capital program for the 10 years (1 April 1989 to 31 March 1999) will require the following total estimated project expenditures:

	($Millions)
Total direct expenditures (including inflation allowance)	4,255
Corporate Overhead	267
Interest During Construction	925
Total Estimated Project Expenditures	5,447*

Note: * Includes estimated expenditures in the 10-year period for Site C ($2,674 million), Keenleyside ($650 million) and starts on future generation projects ($692 million).

For the first year of the Plan (1989/90), it is estimated that the total expenditures required will amount to $130 million, including allowances for inflation, corporate overhead and interest during construction.

Project expenditures forecast over the 10-year period are summarized in Table 3 and shown graphically in Fig. 2.

Ongoing surveys and investigations (Operating Programs separate from this Plan) will continue to review opportunities for obtaining additional energy from existing plants, review problems experienced in the electric power system, and review the integrity of B. C. Hydro's existing dams and the stability of reservoir slopes. These surveys and investigations may result in a requirement to carry out further capital work not covered in the Plan.

Table 1

B.C. Hydro Probable Integrated System Peak Loads With Adjustments

INTEGRATED SYSTEM - 1988/89 to 1998/99 FORECAST
PEAK MW LOAD, INCLUDING THE EFFECTS OF E+ AND DSM PROGRAMS

	88/89	89/90	90/91	91/92	92/93	93/94	94/95	95/96	96/97	97/98	98/99
Probable Domestic Forecast	7260	7480	7690	7880	8030	8240	8460	8680	8890	9130	9400
plus West Kootenay Power & Light Requirement co-incident with BCH system peak	152	40	17	71	78	86	99	110	119	133	147
plus Seattle City Light Requirement Requirement co-incident with BCH system peak	124	124	124	124	124	124	124	124	124	124	124
Total "BCH + WKPL Req. + SCL Req."	7536	7644	7831	8075	8232	8450	8683	8914	9133	9387	9671
* Total Peak Demand (rounded value)	7540	7640	7830	8080	8230	8450	8680	8910	9130	9390	9670

* Note: This row of figures corresponds to the values shown as "Integrated System Peak (MW)" in Table 3.1 of the report "B.C. Hydro Electric Load Forecast 1988/89 - 2008/09" by Forecasting Department, Corporate Affairs. Table 3.1 is titled "B.C. Hydro Probable Gross Load Requirements by Major Sectors (Including SCL & WKPL)".

Adjustment for DSM effects:											
DSM load subtracted	-1	-25	-65	-111	-172	-221	-273	-321	-351	-379	-412
SUBTOTAL NET PEAK DEMAND "BCH + WKPL + SCL - DSM" (rounded value) *	7540	7610	7760	7960	8060	8230	8410	8590	8780	9010	9260

* Note: This row of figures corresponds to the values shown as "Probable Forecast System Coincident Peak" in the table "Peak Load, Generation Capability and System Reserve" found in the Load Forecast section of the report "Electric System Plans and Evaluations 1989/90-1998/99".

Adjustment for E+ effects:											
E+ load added	20	36	50	62	62	62	62	62	62	62	62
TOTAL NET PEAK DEMAND "BCH + WKPL + SCL + E+ - DSM" (rounded value)	7560	7650	7810	8030	8120	8290	8470	8650	8840	9070	9320

Note: The above DSM and E+ values correspond to the values shown in the report "B.C. Hydro Electric Load Forecast 1988/89 - 2008/09", in particular Table 5.3 "Power Smart (Demand Side Management) Programs and Table 5.2 "Interruptible Marketing (E+) Programs".

10 May 1989

TABLE 2

RECOMMENDED RESOURCE PLAN

Year	Resource	Annual Energy Contribution
Ongoing	Demand-Side Management Programs	Increasing to about 2400 GW·h by the year 2000
1989	Coordination of Columbia River Projects with BPA	1 000 GW·h
Ongoing	Resource Smart	860 GW·h
1994	Independent Power Producers	1 000 GW·h
1995	Coordination/Purchase Agreement with Alcan	2 760 GW·h
1998	Keenleyside	1 140 GW·h
1999	Peace Site C	4 700 GW·h
Post 2000	Additional Resources	

Resource Planning
March 1989
VR973

ELECTRIC :
ESTIMATE OF TC
For The Ten-

Prior-Years' Expenditures			Ref.	
Actual to 31 Mar. 1988	12 Months to 31 Mar. 1989 (Estimate)	Est'd Total	No	
				SECTION I: APPROVED PROJECTS IN PROGRESS
	942	942	1A.1	John Hart Rehabilitation/Remedial Work
106	341	447	1A.2	John Hart G.S. - Surge Towers
1	3,103	3,104	1A.3	Dam Safety Rehabilitation/Remedial Work
1,200	2,984	4,184	1A.4	Bridge River Area Stations - Upgrading
2,163	19,352	21,515	1A.5	Dunsmuir - Gold River 230 kV Supply
127	9,787	9,914	1A.6	Stewart Integration
	1,084	1,084	1A.7	Howe Sound Pulp (HSP) 230 kV Supply
126	2,511	2,637	1A.8	American Creek Capacitor Station
20	823	843	1A.9	Lantzville Substation
	35	35	1A.10	Nelway Substation - Phase Shift Transformer
173	949	1,122	1A.11	500 kV Capacitor Stations - Improvements
269	829	1,098	1A.12	System Line Relay (HZ) Replacement Program
467	1,529	1,996	1A.13	Mountain Top Radio Repeater Replacement
9,551	9,954	19,505		Other Plant (1B, 1C, 1D, 1E)
14,203	54,223	68,426		TOTAL APPROVED PROJECTS IN PROGRESS
				SECTION II: PROJECTS TO BE INITIATED JANUARY 1989 TO MARCH
			2A.1	John Hart G.S. - Switchyard
	41	41	2A.2	Additional Energy Program - Revelstoke
			2A.3	Dam Safety Rehabilitation/Remedial Work
	12	12	2A.4	Strathcona Dam - Intake Tower Stabilization
			2A.5	Seismic Stability - Early Attention Items
195	200	395	2A.6	Williston - Kelly Lake 500 kV Supply
	264	264	2A.7	Kelly Lake - Cheekye 500 kV Supply
517	1,096	1,613	2A.8	Peace 500 kV Transmission Uprating
32	3	35	2A.9	Selkirk - Washington Water Power Intertie
	197	197	2A.10	Aldergrove Area - Puget Power Intertie
			2A.11	Malaspina Substation - Static VAR Compensation
	11	11	2A.12	Selkirk Substation - 500 kV Transformer
			2A.13	Control Centre Redevelopment
	242	242		Other Plant (2B, 2C, 2D, 2E)
744	2,066	2,810		TOTAL PROJECTS TO BE INITIATED JANUARY 1989 TO MARCH 199
				SECTION III: PROJECTS TO BE INITIATED BEYOND 1989/90
65,965		65,965	3A.1	Site C Project
3,094		3,094	3A.2	Keenleyside Project
			3A.3	Other Future Major Projects (Starts)
			3A.4	Future Dam Safety
			3A.5	Nicola - Meridian 500 kV Supply
			3A.6	Static VAR Compensation
833	6	839	3A.7-14	Other Major System Expansion/Redevelopment
1,516		1,516		Other Plant (3B, 3C, 3D, 3E)
71,408	6	71,414		TOTAL PROJECTS TO BE INITIATED BEYOND 1989/90
86,355	56,295	142,650		**TOTAL SYSTEM PLAN PROJECTS (I + II + III)**
				Less Prior Years' Expenditures
				Less Required to Complete Expenditures
				Ten-Year Estimate of Total Expenditures

ELECTRIC SYSTEM PLANS AND EVALUATIONS

TABLE 3

TIMATE OF TOTAL PROJECT EXPENDITURES ($ 000'S)

For The Ten-Year Period 1 April 1989 to 31 March 1999

	Job Total	Expenditures For Fiscal Year Ending 31 March									Required to Complete
		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	
	4,916	1,800	1,496	678								
	5,733	5,286										
ork	15,819	12,715										
	5,559	964	411									
	36,254	14,739										
	19,390	9,476										
	1,719	635										
	19,466	10,748	6,081									
	8,794	3,762	4,189									
ormer	7,296	2,862	4,399									
nts	1,940	614	204									
rogram	8,253	2,291	2,385	2,479								
nent	4,528	1,315	1,217									
	44,017	17,890	6,471	151								
	183,684	86,097	26,853	3,308								
1989 TO MARCH 1990												
	18,383	1,705	12,006	4,672								
e	14,497	3,103	3,118	3,241	4,994							
ork	8,467	2,529	5,285	653								
ation	3,317	335	2,970									
	7,599	5,275	1,410	914								
	163,869	2,880	3,473	18,323	20,242	80,969	36,499	1,088				
	166,479	1,450	5,215	8,355	12,873	38,774	57,694	40,307	1,547			
	9,686	3,761	2,191	2,121								
tie	35,099	140	179	61	457	1,269	14,448	18,414	96			
	34,468	261	1,497	11,532	20,902	77						
pensation	22,367	11	176	669	10,209	11,302						
r	10,561	850	9,700									
	48,243	753	6,298	19,699	14,587	6,906						
	63,040	22,136	23,642	16,789	231							
9 TO MARCH 1990	606,073	45,189	77,160	87,029	84,495	139,297	108,641	59,809	1,643			
1989/90												
	3,271,890			8,294	22,346	119,592	239,400	332,256	518,512	759,755	673,568	532,202
	670,673		1,761	7,033	15,218	39,506	34,002	107,674	167,131	180,713	98,209	16,332
	692,648					1,672	1,972	10,603	51,510	229,684	397,207	
	57,379		9,765	14,327	4,852	4,553	4,732	3,282	5,121	5,324	5,423	
	209,277			190	493	2,087	6,976	12,976	50,897	82,806	52,137	715
	54,449						219	781	12,183	14,360	12,914	14,292
lopment	253,831		568	2,756	3,189	17,202	30,725	28,071	54,520	61,890	54,071	
	153,264		3,732	11,038	19,779	19,855	18,578	19,669	22,327	23,174	13,596	
/90	5,363,411		15,826	43,638	65,877	204,467	336,604	515,312	882,201	1,357,406	1,307,125	563,541
	6,153,168	130,286	119,830	133,975	150,372	343,764	445,245	575,121	883,844	1,357,406	1,307,125	563,541
	142,650											
98	563,541											
	5,446,977											

NOTE Includes allowance for inflation, corporate overhead & interest during construction

Indices used: Inflation 4% annually, Interest During Construction 10% annually

FIGURE I

PROPOSED GENERATION AND MAJOR TRANSMISSION ADDITIONS TO 1998

ELECTRIC SYSTEM PLAN EXPENDITURES

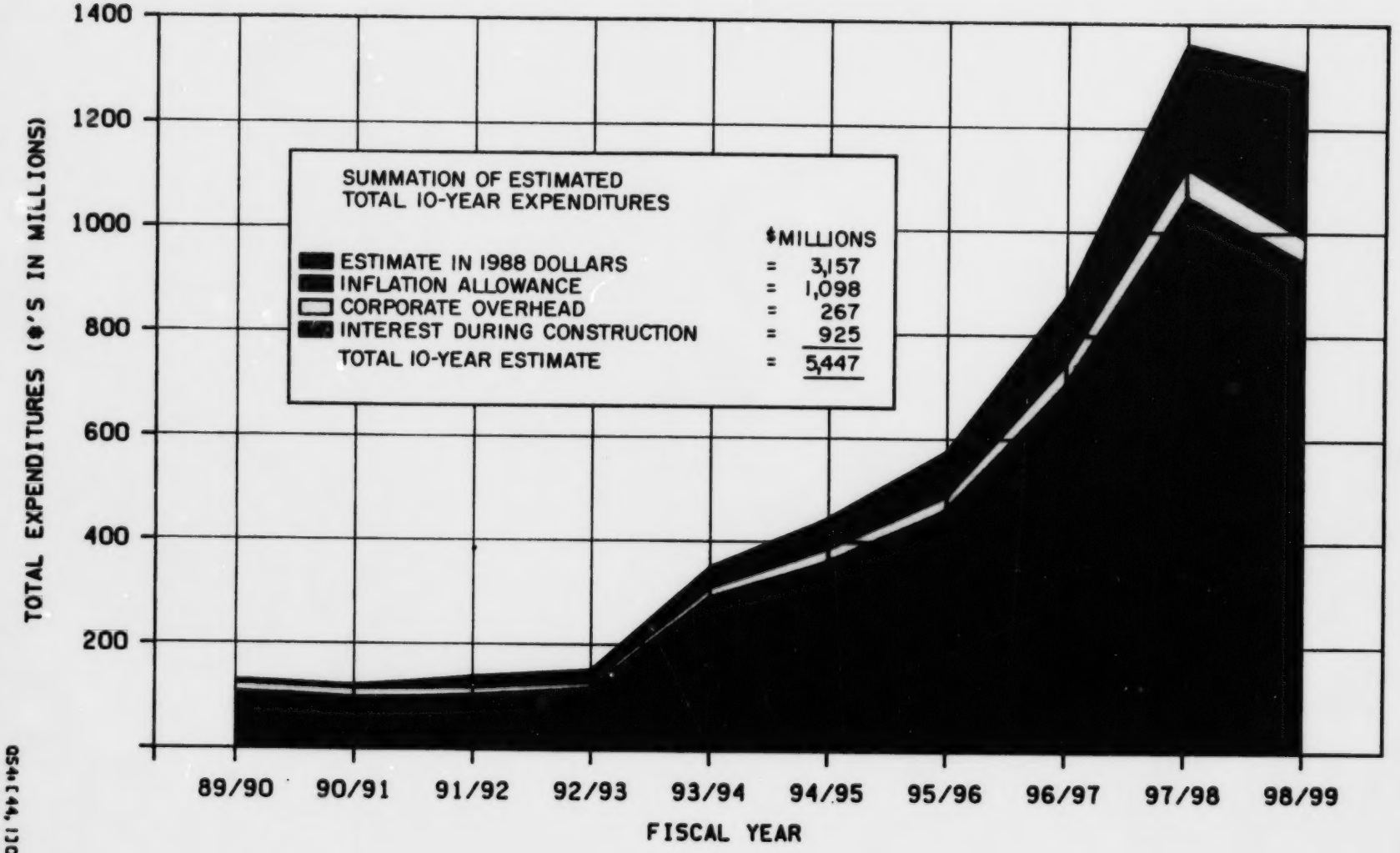

FIGURE 2

QS+144, 13COSTS.DGN

APPENDIX A

B. C. HYDRO ELECTRIC SYSTEM TECHNICAL PLANNING CRITERIA

The Electric System Development Plan was developed on the basis of system planning criteria outlined in this Appendix.

LOAD FORECAST

B. C. Hydro's electric load forecasts consist of five separate projections of peak and energy demands. In addition to the Probable forecast, the 5th, 25th, 75th and 95th percentile forecasts have been defined, indicating the degree of uncertainty in electric growth outlook. These forecasts primarily cover the next decade, and provide an outlook for the following decade for long-term planning purposes.

Load reductions that could arise from demand-side management (DSM) programs are deducted from the original forecast.

GENERATION PLANNING

Energy

Plant additions and energy purchases are scheduled on a probabilistic basis so that the expected cost of meeting the customers' energy demands over the long-term will be minimized. The following generation resources are included:

1. The firm energy capability of hydroelectric plants are estimated assuming a repetition of historic critical water conditions. Critical water conditions are defined as the lowest streamflow sequence for the hydro system as a whole during the 45-year period from 1940/41 to 1984/85. Natural inflows to major reservoirs averaged approximately 15 percent below average during the 1940-1946 critical period.

   Secondary hydro energy would be used to reduce energy purchases, thermal generation and also would be sold in interruptible domestic and export markets.

2. The Burrard Thermal Plant would be operated on "valley" gas which is surplus natural gas seasonally available between March and October. Current estimates of "valley" gas availability would permit a maximum annual Burrard output of 3430 GW·h. During a recurrence of the critical period, Burrard could contribute an average of 3170 GW·h annually, corresponding to a 40 percent annual capacity factor for the 900 MW plant.

3. Existing and future thermal generation plant whose maximum annual capacity factors could range from 60 to 80 percent, depending on the type, size and maturity of individual units.

   Higher fuel-cost thermal plants such as gas turbines would be expected to operate only during low streamflow periods or to meet very high loads.

4. Firm purchase contracts.

5. Downstream benefits arising from the Columbia River Treaty. The Canadian entitlement to downstream power and energy benefits resulting from the operation of storage at the Duncan, Arrow and Mica projects was sold to the United States for a period of 30 years from the commencement of operation of each project. These 30-year periods begin to expire in 1998/99, at which time the benefits will revert to Canada.

6. Other energy sources such as operation of the Burrard Thermal Plant with special fuel-supply contracts; non-firm energy purchases from Alcan, TransAlta or U.S. utilities and purchase of co-generated energy from industrial customers. It is assumed that sufficient transmission capacity exists to deliver the energy from these resources.

Peak Capacity

The peak capacity of the electric system is designed to meet or exceed the forecast one-hour peak demand and to provide a peak reserve margin. B. C. Hydro is a member of the Western Systems Coordinating Council (WSCC), which allows member utilities to select one of three peak reserve criteria. B. C. Hydro, like most other utilities throughout North America, has chosen to adopt the loss-of-load probability criteria. This method comprises a probabilistic analysis of simultaneous outages of generating equipment, using a maximum risk criteria of loss-of-load of one day in ten years. That is, the probability that there would be insufficient generating resources available to meet the forecast peak load each year should be one-tenth of a day per year or less.

No allowance is made for emergency peak support through B. C. Hydro's interconnection with the U.S. Northwest Power Pool. However, an allowance is made for the emergency peak reserve that may be available to B. C. Hydro through the 500 kV interconnection with TransAlta which is assumed to increase B. C. Hydro's firm peak reserve by 400 MW.

BULK TRANSMISSION SYSTEM

The bulk transmission system must be capable of withstanding a single contingency outage during peak load periods or other high-stress conditions and meet the following performance standards.

Circuit Loading

Overhead and cable circuit loadings are limited by one or more of the following:

- Thermal

  In general, overhead conductor temperature at emergency current loading is not to exceed 90°C to prevent loss of conductor strength. Cable circuits are limited to manufacturers' recommended ratings, depending upon the specific cooling system.

- Ground Clearance

  Overhead circuits are designed to meet or exceed specified minimum ground clearances.

- Voltage Drop

  Up to 10 percent voltage drop may be permitted following an outage of a major system component.

- Stability

  Circuit loading may be limited to less than allowed above by either voltage stability or electro-mechanical stability of the overall network. The system must remain stable after a 3-phase fault with one unsuccessful reclosure at critical points in the transmission system or after a single-line-to-ground faults with breaker failure. Adequate voltage stability margins must be maintained at critical buses.

Security

In general, there will be no loss of load or generation, no overloading of transmission circuits, and no undervoltages during any single transmission circuit outage. Economics may prevent strict adherence to this rule in special cases such as, for example, the present single circuit supply from Prince George to Terrace.

During high-level interruptible export conditions, generation shedding is permitted on the loss of any single transmission element. During firm export conditions, transmission system performance should match that for firm domestic loads. As a member of the Western Systems Coordinating Council, B. C. Hydro must demonstrate that disturbances on the B. C. Hydro system will not cause cascading disturbances into neighbouring utilities.

Single circuit towers are generally used to avoid the loss of two major circuits during a tower failure.

Multiple circuit towers are used where right-of-way is restricted.

All 500 kV, and many 230 kV circuits are automatically re-energized once after tripping.

AREA TRANSMISSION SYSTEM

All peak forecast loads including industrials are to be served, but the security of service over peak varies depending on location, loading and customer requirements.

1. In high density distribution load areas, area transmission is provided to carry full peak load with one circuit out-of-service; remaining circuit(s) are to be within design clearances, ampere and voltage limits. Industrial loads are generally served with a single-circuit supply.

2. At the other extreme, in rural areas where loads are relatively small and distances large, only one circuit can be justified. Service is interrupted on failure of the circuit. In rural areas which have just been integrated to the main system, having previously been served from a diesel plant, the diesel plant may be retained in situ for a year or two as partial standby.

3. In medium density load areas multiple circuits are normally provided to serve the area on a firm basis. In some cases where the area load approaches or exceeds the capability of the area supply system with one circuit out of service, or where the area supply system is in parallel with the bulk transmission system and a contingency on that system overloads the area supply system, then some load shedding or system separation may be initiated for the period of the emergency condition.

   In many cases, a single attempt is made to automatically re-energize overhead circuits after tripping. Oil-filled cable circuits are not re-energized automatically.

   As for the bulk transmission system, multiple circuit towers may be used where right-of-way is restricted.

STATIONS

Station arrangements vary from complex bus arrangements for important 500 kV and bulk supply stations to elementary arrangements for small distribution substations. A proper balance is sought between the needs for reliability, importance of the station in the network, maintainability and cost. Important stations are arranged to allow any single element to be out of service yet maintain electric supply. To reduce station costs in subtransmission systems, stations may have no high voltage circuit breakers.

For distribution supply station transformers, an emergency overload of approximately 133 percent of maximum nameplate rating is allowed, but for bulk supply station transformers a more conservative emergency overload between 100 and 120 percent is used for planning. On-load tap changing transformers are extensively used throughout the electric system to reduce the need and costs for other voltage regulating equipment. However, on-load tap changers are not used in the major 500 kV system transformers in order to keep them as simple as possible and hence improve their reliability. Mobile transformers are available in the system to provide back-up capability for transformer failures at single transformer stations. These are usually installed at smaller capacity, rural stations.

Average feeder loadings used are 10 MV·A for 25 kV, 5 MV·A for 12 kV and 2 MV·A for 4 kV. The small amount of distribution remaining at 4 kV is being replaced by higher distribution voltages as quickly as possible and as economic factors dictate.

A feeder tie breaker and transfer bus is generally provided in distribution stations which have four or more active feeder positions. This permits uninterrupted supply to customers while maintaining equipment and provides an alternative supply following station equipment failures.

Current-limiting reactors are used extensively at the distribution supply stations to limit distribution fault currents, thus permitting a more economical distribution system design, allowing joint pole use with other utilities, more economical customer's entrance switchgear and reduced damage from faults.

Feeder bus section loads are planned to be no more than 30 to 50 MV·A in order to limit possible load curtailment following bus faults. In some distribution stations, an alternate bus supply is provided for emergencies and maintenance purposes.

Protective relaying systems are employed throughout the power system to interrupt and clear electrical faults and to protect against abnormal conditions. System protection criteria reflect an obligation to protect plant, employees and the general public against electrical hazards by ensuring prompt and reliable clearing of all detectable faults.

DIESEL PLANT

Where integration to the main system cannot be justified, diesel plants serve residential and commercial loads and, under some conditions, light industrial loads.

Sufficient capacity is provided to meet the forecast winter peak load with the largest diesel unit out of service.

Fuel storage is sized to suit the fuel delivery schedule for the area.

For small installations (350 kW or less), diesel unit sizes are selected to allow for the full load to be supplied by a single unit.

For larger installations parallel operation of diesel units is provided. Provision is made for remote control operation of mobile diesels within a station.

Trailer-mounted mobile diesel generating units are used extensively to provide greater flexibility in maintenance and to save capital.

Transformers - Spare firm transformer capacity is not provided at diesel generating stations. However, a spare transformer may be provided within the region.

Switching - Switching is provided to allow for parallel operation of all units before energizing the load in order to enable pick-up after outages.

General - Areas now served by diesel plant will be integrated into the system when it becomes economic to do so.

CONTROL AND COMMUNICATIONS

Control and communications facilities are provided for three purposes:

1. Electric System Integrity

   a. Communication channels are provided for protective relaying to meet the specific speed, security and reliability requirements.

   b. Control and communications facilities are provided for generation shedding with the speed, security, and reliability necessary to maintain system stability.

2. Electric System Operation

   Control and communications facilities are provided for operation of the electric system. Control facilities include control of the majority of generating stations and substations from the system and/or area control centres, and automatic generation control for control of tie line power flows. Communications facilities include microwave radio systems, power line carrier, mobile and radio system, fibre-optic and wire line systems, the internal telephone system, a dispatch intercom, and voice and data communications with BPA, TransAlta Utilities, WKP&L and Alcan.

3. Operations Administration

   When spare communication channels are available, and when cost savings can be achieved, various facilities may be provided for administrative functions associated with electric system operation. Examples include:

1. the B. C. Hydro-owned telephone system;

2. computer functions such as the Customer Information Systems and the Project Facilities Management System;

3. remote reading of oscillograph records (fault recording) and event recording; and

4. transmission of data and facsimile information.

APPENDIX B

1989/90-1998/99 NON-COINCIDENT SUBSTATION AND INDUSTRIAL LOAD FORECAST

SUMMARY OF NON-COINCIDENT SUBSTATION AND INDUSTRIAL MV-A LOADS

Division	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
SUBSTATION:												
Metro - West	1244.1	1284.9	1322.2	1354.2	1385.1	1415.6	1446.8	1481.6	1519.0	1555.8	1593.0	1631.2
Metro - East	373.3	382.2	399.2	410.5	425.9	437.7	449.9	462.2	474.7	488.2	501.1	515.0
North Shore/Coastal	367.6	385.7	403.0	416.0	429.1	440.6	452.2	464.7	477.1	490.1	503.5	517.7
Fraser Valley	813.1	815.8	840.6	866.4	888.2	911.0	933.9	961.0	986.3	1013.4	1041.5	1070.2
Vancouver Island	1106.5	1205.4	1240.6	1276.1	1308.4	1334.9	1362.6	1393.3	1428.5	1464.7	1501.7	1541.6
Central Interior	480.6	517.4	523.9	530.3	536.6	543.5	550.3	559.3	569.0	578.2	588.2	597.7
North Coast	149.0	165.4	167.5	169.3	171.7	173.6	175.6	178.4	181.4	184.2	187.3	190.4
South Interior - West	481.6	495.4	505.4	514.5	522.9	531.4	540.6	550.0	562.9	572.9	582.9	593.2
South Interior - East	133.8	135.1	137.0	139.1	141.3	143.6	145.8	148.1	150.4	152.8	155.3	157.7
TOTAL SUBSTATION	5149.7	5387.4	5539.4	5676.4	5809.2	5931.9	6057.7	6198.6	6349.4	6500.3	6654.5	6814.7
INDUSTRIAL:												
Lower Mainland	588.0	650.7	582.7	674.3	688.1	694.3	766.0	803.3	820.5	828.6	853.3	875.8
Vancouver Island	565.3	627.6	723.1	735.9	752.9	753.9	744.9	773.8	753.7	750.1	731.9	734.0
Central Interior	446.9	559.6	567.7	575.9	576.9	560.8	562.8	567.1	593.3	630.3	632.4	635.4
North Coast	127.4	128.5	128.5	128.5	128.5	110.3	110.3	110.3	111.4	111.4	121.7	126.9
South Interior	318.4	338.9	356.8	359.8	333.2	337.4	339.4	358.0	368.2	370.2	323.6	366.8
TOTAL INDUSTRIAL	2046.0	2305.3	2358.8	2474.4	2479.6	2456.7	2523.4	2612.5	2647.1	2690.6	2662.9	2738.9
TOTAL SUBSTATION & INDUSTRIAL	7195.7	7692.7	7898.2	8150.8	8288.8	8388.6	8581.1	8811.1	8996.5	9190.9	9317.4	9553.6

LOWER MAINLAND DIVISION (METRO-EAST)
SUBSTATION LOAD FORECAST
NON-COINCIDENT MV-A

Area Metro-East	kV	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	Power Factor
Annacis	12	28.2	25.8	28.2	29.1	30.0	31.0	32.0	33.0	34.0	35.1	36.2	37.3	0.90
Barnard	12	116.5	125.5	130.7	131.8	134.9	138.1	141.4	144.8	148.2	151.8	155.4	159.2	0.95
Como Lake	25	68.0	71.6	74.0	78.6	81.2	84.0	86.8	89.7	92.7	95.9	99.1	102.5	0.93
Coquitlam	12	24.5	25.4	26.0	26.6	27.3	28.0	28.7	29.4	30.1	30.9	31.7	32.5	0.93
Maple Ridge	12	11.6	12.9	11.3	- - - - - - - - - - - - To Maple Ridge 25 kV - - - - - - - - - - - -									0.93
Maple Ridge	25	59.3	60.8	65.3	78.6	80.6	82.5	84.7	86.8	89.0	91.5	93.5	95.9	0.93
New Westminster	12	47.6	42.5	44.8	45.8	50.7	51.8	45.4	46.5	47.6	48.7	49.8	51.0	0.97
Royal	4	9.1	9.2	- - - - - - - - - - - - To Royal 12 kV - - - - - - - - - - - -										0.97
Royal	12	- - - - - - -		10.3	11.4	12.5	13.6	22.1	23.2	24.3	25.4	26.5	27.6	0.97
Whonnock	12	8.5	8.5	8.6	8.6	8.7	8.7	8.8	8.8	8.8	8.9	8.9	9.0	0.90
Total		373.3	382.2	399.2	410.5	425.9	437.7	449.9	462.2	474.7	488.2	501.1	515.0	

LOWER MAINLAND DIVISION (METRO-WEST)
SUBSTATION LOAD FORECAST
NON-COINCIDENT MV·A

Area Metro-West	kV	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	Power Factor
Cambie Road	12	4.2	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	0.91
Cambie Road	25	71.3	73.1	74.9	76.8	78.7	80.7	82.7	85.6	88.6	91.7	94.9	98.2	0.91
Camosun	12	53.8	56.9	58.0	59.1	60.2	61.4	62.9	64.4	66.0	67.5	69.2	70.8	0.95
Cathedral Square	12	72.0	76.5	79.3	95.3	100.2	104.6	109.4	113.3	122.6	127.2	131.6	135.7	0.92
Dal Grauer	12	120.3	122.3	124.3	120.6	121.6	122.5	123.5	124.6	120.7	121.5	122.4	123.5	0.91
George Dickie	4	23.4	23.6	23.9	24.1	24.4	24.6	24.8	25.1	25.3	25.6	25.9	26.1	0.95
Horne Payne	12	99.0	101.5	104.0	106.6	109.3	112.0	114.8	118.3	121.8	125.5	129.2	133.1	0.94
Kidd No. 1	4	13.0	13.1	13.3	13.4	13.5	13.7	13.8	13.9	14.1	14.2	14.4	14.5	0.95
Kidd No. 1	12	43.6	44.5	45.8	47.2	48.1	49.1	50.1	51.3	52.6	53.9	55.3	56.6	0.89
Lougheed	12	44.7	45.6	46.5	47.4	48.4	49.4	50.3	51.3	52.4	53.4	54.5	55.6	0.93
Mainwaring	12	142.2	145.0	147.9	150.9	153.9	157.0	160.1	164.1	168.2	172.5	176.8	181.2	0.95
Murrin	4	7.2	7.4	7.5	7.6	7.7	7.8	7.9	8.0	8.1	8.2	8.3	8.4	0.90
Murrin	12	158.9	161.5	164.6	161.9	164.5	166.6	169.2	171.6	174.0	176.7	178.9	181.8	0.93
Newell	12	120.0	132.4	141.8	145.3	148.9	152.5	155.1	158.0	162.3	165.1	168.0	170.9	0.95
Richmond	12	102.4	105.0	107.6	103.3	106.0	101.9	104.8	99.8	104.0	99.3	103.6	108.1	0.95
Sea Island	12	16.2	16.6	19.1	20.2	21.3	22.1	22.7	23.2	23.8	24.4	25.0	25.6	0.92
Sperling	4	5.0	- To Sperling 12 kV -											0.93
Sperling	12	108.3	116.0	118.8	121.6	124.5	127.5	131.2	135.1	139.0	143.0	147.1	151.5	0.95
Steveston	25	38.6	39.6	40.6	48.6	49.6	57.9	59.2	69.7	71.2	81.8	83.6	85.3	0.95
Total		1244.1	1284.9	1322.2	1354.2	1385.1	1415.6	1446.8	1481.6	1519.0	1555.8	1593.0	1631.2	

LOWER MAINLAND DIVISION (NORTH SHORE/COASTAL)
SUBSTATION LOAD FORECAST
NON-COINCIDENT MV-A

Area

North Shore/Coastal	kV	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	Power Factor
Britannia	34	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.95
Capilano	12	41.0	41.8	42.7	43.5	44.4	45.3	46.2	47.1	48.0	49.0	50.0	51.0	0.95
Deep Cove	12	24.9	25.9	26.9	28.0	29.1	30.3	31.5	32.8	34.1	35.4	36.9	38.3	0.95
Forestview	12	8.4	8.7	8.9	9.2	9.3	9.5	9.6	9.8	10.0	10.2	10.4	10.6	0.96
Forestview	25	7.9	8.1	8.4	8.6	8.8	8.9	9.0	9.2	9.4	9.6	9.8	10.0	0.96
Furry Creek	4	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.93
Gibsons	25	15.5	16.0	16.4	16.9	17.4	18.0	18.5	19.1	19.6	20.2	20.8	21.5	0.93
Glenmore	4	8.8	8.9	9.0	9.1	9.2	9.2	9.3	9.4	9.5	9.6	9.7	9.8	0.95
Grief Point	12	14.5	14.9	15.4	15.8	16.2	16.5	16.8	17.2	17.5	17.8	18.2	18.6	0.93
Hillcrest	12	7.4	7.5	7.7	7.9	8.0	8.2	8.3	8.5	8.7	8.8	9.0	9.2	0.95
Horseshoe Bay	12	16.3	16.6	17.0	17.3	17.6	18.0	18.4	18.7	19.1	19.5	19.9	20.3	0.95
John Lawson	12	23.5	24.0	26.4	26.9	27.4	28.0	28.6	29.1	29.6	30.2	30.8	31.4	0.98
Lions Bay	12	3.3	3.4	3.4	3.5	3.6	3.6	3.7	3.8	3.9	3.9	4.0	4.1	0.95
Lynn Valley	12	17.2	21.7	22.2	27.8	28.4	29.2	34.9	35.7	36.8	37.6	38.5	39.5	0.95
Norgate	12	27.1	27.4	28.6	28.9	29.2	29.4	29.7	30.0	30.2	30.5	30.7	31.0	0.93
North Vancouver	4	10.5	10.8	11.0	11.3	11.6	11.9	12.2	12.5	12.8	13.1	13.4	13.8	0.93
North Vancouver	12	44.0	44.1	45.1	41.2	44.2	45.1	41.1	42.1	42.8	43.8	44.9	45.8	0.95
Pemberton	25	4.5	4.7	5.0	5.2	5.5	5.7	6.0	6.3	6.6	7.0	7.3	7.7	0.93
Pender Harbour	25	5.6	5.7	5.8	5.9	8.2	8.3	8.5	8.6	8.9	9.0	9.2	9.4	0.95
Porteau	12	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.95
Rainbow	25	40.1	47.1	53.2	57.6	60.2	63.2	66.1	69.3	72.5	76.0	79.5	83.3	0.93
Sechelt	25	21.3	21.9	22.6	23.3	21.9	22.6	23.2	24.0	24.7	25.5	26.2	27.1	0.93
Squamish	25	24.8	25.5	26.3	27.1	27.9	28.7	29.6	30.5	31.4	32.4	33.3	34.3	0.93
Total		367.6	385.7	403.0	416.0	429.1	440.6	452.2	464.7	477.1	490.1	503.5	517.7	

LOWER MAINLAND DIVISION (FRASER VALLEY)
SUBSTATION LOAD FORECAST
NON-COINCIDENT MV·A

Area Fraser Valley	kV	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	Power Factor
Abbotsford	12	27.5	28.1	28.6	29.2	29.8	30.4	31.0	31.7	32.5	28.9	29.5	30.1	0.93
Arnott	25			13.6	13.9	14.2	14.6	14.9	15.3	15.7	16.1	16.5	16.9	
Atchelitz	25	33.2	33.5	34.0	34.5	35.0	35.6	36.1	36.8	37.5	38.3	41.3	42.1	0.94
Balfour	12	21.9	22.2	22.6	22.9	23.2	23.6	23.9	22.2	22.9	23.4	24.0	24.6	0.93
Boston Bar	25	8.9	8.9	9.0	9.0	9.1	9.1	9.2	9.2	5.9	5.8	5.8	5.8	0.88
Chilliwack	12	38.1	38.3	39.1	39.8	40.6	41.5	42.3	43.3	44.4	45.5	44.5	45.5	0.93
Clayburn	25	53.2	54.5	55.9	57.3	58.7	60.2	68.7	73.0	75.3	82.0	84.4	86.9	0.95
Cloverdale	12	20.2	20.6	21.0	21.4	21.9	22.3	22.7	23.2	23.7	22.1	20.5	18.9	0.93
Delta	12	28.9	27.0	15.7	16.1	16.6	17.0	17.5	18.3	19.1	20.0	20.9	21.8	0.90
Hope	12/25	11.5	13.0	13.5	13.6	13.6	13.7	13.8	13.8	13.9	14.0	14.0	14.1	0.93
Kent	12	8.6	8.7	9.2	9.3	9.4	9.5	9.6	9.7	9.8	9.9	10.0	10.1	0.95
McLellan	25	70.8	72.6	74.4	76.2	78.1	80.1	82.1	85.0	88.0	91.0	94.2	97.5	0.93
Mission	25	37.5	38.1	38.6	39.2	39.8	40.4	41.0	41.8	42.7	43.5	44.4	45.3	0.95
Port Kells	25	52.6	53.7	54.7	55.8	56.9	58.1	59.2	61.0	62.8	64.7	66.7	68.7	0.93
Scott	12	46.0	45.7	48.4	50.6	51.3	52.1	52.8	54.1	55.3	56.7	58.0	59.4	0.91
Spuzzum	12	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	
Strawberry Hill	25	70.0	73.8	76.7	82.2	85.4	88.7	92.1	95.6	99.3	103.1	107.1	111.3	0.93
Sumas Way	25	54.6	40.1	41.1	42.1	43.2	44.3	38.4	39.5	40.7	42.0	43.3	44.6	0.95
Surrey	12	20.9	21.5	20.2	21.8	22.5	23.2	24.0	24.7	25.5	26.3	27.1	27.9	
Tsawwassen	25	42.6	43.5	44.3	45.2	46.1	47.0	48.0	48.9	49.9	50.9	51.9	53.0	0.96
Vedder	12	6.3	6.4	6.4	6.5	6.6	6.6	6.7	6.8	6.8	6.9	7.0	7.0	0.94
Wahleach	12	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	0.93
Whalley	12	97.8	101.2	88.7	91.8	95.2	82.6	85.5	88.7	91.9	95.1	98.6	102.1	0.93
Whalley	25			18.1	18.6	19.0	35.6	36.7	37.7	38.9	40.2	41.4	42.7	
White Rock	25	59.1	61.5	63.9	66.5	69.1	71.9	74.8	77.8	80.9	84.1	87.5	91.0	0.96
Total		813.1	815.8	840.6	866.4	888.2	911.0	933.9	961.0	986.3	1013.4	1041.5	1070.2	

LOWER MAINLAND DIVISION (METRO AND FRASER VALLEY)
INDUSTRIAL LOAD FORECAST
NON-COINCIDENT MV·A

Area Metro-East, Metro-West, Metro-North Shore/Coastal, Fraser Valley	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	Power Factor
Albright & Wilson (Erco Industries)	49.2	60.6	60.6	60.6									0.99
American Traders Co. Ltd. (Richmond Recycling)	2.4	2.7	2.7	2.7									0.91
Belkin Paperboard	17.9	17.7	17.7	17.7									0.96
Bingham Willamette	1.1	1.0	1.0	1.0									0.98
Cdn. Cement LaFarge (Richmond)	8.6	8.2	8.2	8.2									0.98
Cdn. Occidental Petro (N. Van)	58.3	60.0	60.0	60.0									1.00
Cdn. Occidental (Squamish-NACL)	9.6	10.1	10.1	10.1									0.99
Cdn. Occidental (Squamish-NAOH) (FMC Chemicals)	33.3	33.3	33.3	33.3									0.99
C.F.P. (Eburne)	7.3	7.3	7.3	7.3									0.96
C.F.P. (New Westminster)	7.7	8.3	9.4	9.4									0.96
C.F.P. (Port Mellon)	18.6	18.3	18.3	43.0									0.93
Chatterton	5.2	5.2	5.2	5.2									0.97
Chevron Canada	10.5	10.8	10.8	10.8									0.93
Crown Forest Ind. (Fraser Mills)	11.3	10.6	10.6	10.6									0.94
Esco Ltd. (Port Coquitlam)	7.1	7.0	7.0	7.0									1.00
Fiberglass Canada (Mission)	13.6	13.7	13.7	13.7									0.95
Imperial Oil Canada	12.4	12.4	12.4	12.4									0.97
Inland Cement (Tilbury)	20.1	20.6	20.6	20.6									0.97
IPSCO (Port Moody)	2.2	2.5	2.5	2.5									1.00
IPSCO - Western Canada Steel	30.3	75.3		64.9									0.77
Mac. Bloedel (Fraser River)	9.1	9.1	9.1	9.1									0.99
Mac. Bloedel (Island Paper)	10.6	10.6	10.6	10.6									0.94
Mac. Bloedel (Powell River)	129.6	130.0	130.0	130.0									1.00
Merfin Hygienic Products			5.2	5.2									0.97
Petro Can. (Port Moody)	7.7	7.6	7.6	7.6									0.92
Pioneer Grain Terminal	3.8	4.1	4.1	4.1									0.97
Sapperton Pumps (GVWD)	2.3	2.2	2.2	2.2									0.90
Saskatchewan Wheat Pool	5.7	5.1	5.1	5.1									0.98
Scott Paper	20.2	20.2	20.2	20.2									0.99
Shell Canada	8.3	8.1	8.1	8.1									0.99
Trans Mtn. Oil (Sumas)	1.3	1.3	1.3	1.3									0.97
University of British Columbia	31.0	31.3	32.3	32.3									0.99
Versatile Pacific Shipyards	3.1	5.2	5.2	5.2									0.97
Westcoast Cellufibre	3.2	4.2	4.2	4.2									0.96
Western Pulp Partners (Woodfibre)	16.5	16.8	16.8	16.8									0.95
Westshore Term. (Roberts Bank)	8.9	9.3	9.3	11.3									0.97
L.M. Existing Industrial Load					688.1	694.3	709.3	720.8	738.0	746.1	755.4	762.4	
L.M. Future Industrial Load							56.7	82.5	82.5	82.5	97.9	113.4	
Total	588.0	650.7	582.7	674.3	688.1	694.3	766.0	803.3	820.5	828.6	853.3	875.8	

VANCOUVER ISLAND DIVISION
SUBSTATION LOAD FORECAST
NON-COINCIDENT MV·A

Area Vancouver Island	kV	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	Power Factor
Campbell River	25	64.2	66.7	68.8	70.9	72.9	74.6	76.4	78.4	80.6	82.9	85.3	87.8	0.96
Colwood	25	62.0	69.9	72.5	75.2	77.8	79.9	82.3	84.8	87.7	90.7	93.7	97.0	0.94
Comox	25	30.0	32.0	33.3	35.4	35.9	37.0	38.1	39.3	40.7	42.1	43.5	45.1	0.92
Duncan City	12	11.0	- - - - - - - - Converted to 25 kV & Transferred To Koksilah and Prevost - - - - - - - -											0.95
Esquimalt	12	62.4	69.2	71.4	73.6	75.6	77.1	78.7	80.5	82.5	84.6	86.8	89.1	0.95
George Tripp	25	118.2	130.2	135.1	140.1	144.9	149.0	153.3	158.0	163.5	169.0	174.7	180.7	0.96
Gold River	25	4.6	4.8	4.9	5.1	5.2	5.4	5.6	5.7	5.9	6.1	6.3	6.5	0.94
Goward	12	21.0	23.5	24.3	25.1	25.9	26.7	27.3	28.2	29.0	20.0	20.6	21.2	0.95
Goward	25	- - - - - - - - - 1996/97: Establish 25 kV Feeders - - - - - - - - -									9.9	10.2	10.6	
Harewood	25	69.1	77.0	79.0	64.0	65.6	67.0	68.4	70.1	71.9	66.0	67.7	69.6	0.92
Horsey	12	148.8	162.4	166.1	169.3	172.2	173.8	175.7	177.9	180.4	183.0	175.8	178.6	0.97
Horsey	25	20.3	22.2	22.6	23.1	23.5	23.8	24.1	24.4	24.7	25.0	35.4	35.9	0.97
Jordan River	25	1.4	1.8	1.8	2.0	2.0	2.0	2.0	2.0	2.0	2.1	2.1	2.1	0.95
Keating	25	23.0	26.6	27.5	28.4	39.5	40.4	41.4	42.3	43.6	44.9	46.2	47.5	0.95
Keogh	25	5.1	5.2	5.4	5.5	5.6	5.7	5.8	5.9	6.0	6.2	6.3	6.4	0.95
Koksilah	25	24.0	32.8	33.3	33.7	34.0	34.2	34.4	34.7	35.0	35.4	35.7	36.1	0.94
Ladysmith	25	33.6	37.3	38.3	39.3	40.3	41.1	42.0	43.0	44.2	45.3	46.5	47.8	0.88
Lake Cowichan	25	9.4	10.3	10.4	10.5	10.6	10.7	10.8	10.9	11.0	11.1	11.2	11.3	0.94
Lantzville	25	- - New 1990/91 - - -			31.2	31.9	44.6	45.5	46.6	47.9	55.0	56.4	58.0	
Long Beach	25	11.2	11.7	12.0	12.2	12.4	12.5	12.6	12.8	12.9	13.1	13.3	13.5	0.94
Northfield	25	66.9	75.0	76.9	64.8	66.4	55.8	57.1	58.4	60.0	63.5	65.2	67.0	0.95
Parksville	25	53.2	57.2	58.7	60.3	61.8	63.2	64.7	66.3	68.1	70.0	71.9	74.0	0.94
Port Alberni	12	24.5	26.6	23.1	23.5	23.9	24.1	24.4	24.6	24.9	25.3	25.6	26.0	0.94
Port Alberni	25	25.2	27.7	32.4	33.0	33.5	33.8	34.2	34.5	35.0	35.4	35.9	36.4	0.92
Port Hardy	25	15.5	16.3	17.0	17.7	18.4	19.0	19.4	19.9	20.4	21.0	21.5	22.1	0.95
Port McNeill	25	10.0	11.1	11.4	11.7	11.9	12.1	12.3	12.5	12.8	13.0	13.3	13.6	1.00
Prevost	25	26.0	30.6	31.1	31.4	31.7	31.9	32.1	32.4	32.7	33.0	33.3	33.7	0.94
Puntledge	25	50.5	53.7	55.8	58.0	60.3	62.0	63.8	65.9	68.2	70.5	72.9	75.6	0.93
Saltspring	25	25.1	26.2	27.1	28.1	29.1	30.0	30.9	31.8	33.0	34.1	35.3	36.6	0.92
Shawnigan	25	17.7	18.5	18.8	19.0	19.2	19.3	19.4	19.6	19.7	19.9	20.1	20.4	0.94
Sidney	25	46.8	50.6	52.3	54.0	45.4	46.5	47.6	48.8	50.2	51.6	53.1	54.6	0.96
Sooke	25	16.0	17.0	17.6	17.9	18.5	18.8	19.1	19.5	19.9	20.5	20.9	21.4	0.94
Tahsis Village	25	9.8	10.3	10.6	10.9	11.2	11.5	11.7	12.0	12.4	12.7	13.1	13.5	0.94
Moss	25		1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	1.9	
Total		1106.5	1205.4	1240.6	1276.1	1308.4	1334.9	1362.6	1393.3	1428.5	1464.7	1501.7	1541.6	

VANCOUVER ISLAND DIVISION
INDUSTRIAL LOAD FORECAST
NON-COINCIDENT MV·A

Area Vancouver Island	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	Power Factor
B.C. Forest Products (Crofton)	120.2	145.0	157.0	157.0									1.00
Cdn. Occidental (Nanaimo)	17.0	19.0	20.0	20.0									1.00
C.I.P. (Gold River)	16.0	16.3	76.1	84.8									0.92
C.I.P. (Tahsis)	8.2	7.8	7.8	7.8									0.90
Conuma Fish Hatchery	0.2	0.2	0.2	0.2									0.91
Crown Forest Industries	180.7	225.0	225.0	225.0									1.00
DND (Esquimalt)	8.8	8.8	8.8	8.8									0.91
Ferro-Silicon (Bamberton)													0.97
Mac. Bloedel (Harmac)	22.6	22.8	17.4	17.4									0.92
Mac. Bloedel (Port Alberni)	119.4	110.0	135.0	135.0									1.00
Quinsam Coal				4.1									0.97
Utah Mines	72.2	72.7	75.8	75.8									0.99
V.I. Existing Industrial Load					752.9	753.9	744.9	773.8	753.7	750.1	731.9	734.0	
V.I. Future Industrial Load													
Total	565.3	627.6	723.1	735.9	752.9	753.9	744.9	773.8	753.7	750.1	731.9	734.0	

NORTHERN DIVISION (NORTH COAST)
SUBSTATION LOAD FORECAST
NON-COINCIDENT MV-A

Area North Coast	kV	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	Power Factor
Aiyansh	25	4.3	4.3	4.4	4.4	4.5	4.6	4.6	4.7	4.8	4.8	4.9	5.0	0.92
Diana Lake	7.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.95
Green River	2.4	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.95
Hazelton	25	18.7	18.9	19.2	19.4	19.6	19.9	20.1	20.4	20.8	21.1	21.5	21.8	1.00
Houston	25	12.5	15.0	15.2	15.4	15.6	15.7	15.9	16.2	16.5	16.7	17.0	17.3	0.90
Kalum	25	24.3	26.5	26.8	27.1	27.4	27.8	28.1	28.5	29.0	29.5	29.9	30.4	0.95
Kitsault	25	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.95
Lakelse	12	0.8	0.8	0.8	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.0	0.95
Minette	25	14.7	17.9	18.1	18.3	18.6	18.8	19.0	19.3	19.6	20.0	20.3	20.6	0.98
Oldfield	12	18.5	21.1	21.4	21.6	21.9	22.1	22.4	22.8	23.1	23.5	23.9	24.3	0.97
Oldfield	25	14.9	16.4	16.6	16.8	17.0	17.2	17.4	17.7	18.0	18.3	18.6	18.9	0.97
Port Edwards	25	1.6	2.0	2.0	2.0	2.1	2.1	2.1	2.2	2.2	2.2	2.3	2.3	0.95
Smithers	25	25.2	28.3	28.7	29.0	29.4	29.7	30.1	30.5	31.0	31.5	32.0	32.6	0.95
Terrace	25	12.9	13.6	13.7	13.9	14.1	14.2	14.4	14.6	14.9	15.1	15.4	15.6	0.95
Total		149.01	165.41	167.51	169.31	171.71	173.61	175.61	178.41	181.41	184.21	187.31	190.41	

NORTHERN DIVISION (NORTH COAST)
INDUSTRIAL LOAD FORECAST
NON-COINCIDENT MV-A

Area	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	Power Factor
North Coast													
Amax of Canada Ltd.	0.5	0.5	0.5	0.5									0.99
Equity Silver Mines Ltd.	18.7	18.2	18.2	18.2									0.99
Eurocan P&P (Kitimat)	52.5	54.2	54.2	54.2									0.96
Northwood Pulp (Houston)	8.0	7.7	7.7	7.7									0.91
Ocelot Ammonia (Kitimat)	14.7	14.9	14.9	14.9									0.87
Prince Rupert Grain (Ridley Isl. Terminal Grain)	7.7	7.1	7.1	7.1									0.99
Ridley Isl. Terminal (Coal)	8.4	8.4	8.4	8.4									0.95
Skeena Cellulose (Westar - B.C. Timber)	16.9	17.5	17.5	17.5									0.97
N.C. Existing Industrial Load					128.5	110.3	110.3	110.3	111.4	111.4	111.4	111.4	
N.C. Future Industrial Load											10.3	15.5	
Total	127.4	128.5	128.5	128.5	128.5	110.3	110.3	110.3	111.4	111.4	121.7	126.9	

NORTHERN DIVISION (CENTRAL INTERIOR)
SUBSTATION LOAD FORECAST
NON-COINCIDENT MV·A

Area Central Interior	kV	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	Power Factor
Babine Lake	25	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	0.93
Beaverley	25	19.2	20.2	20.4	20.7	21.0	21.2	21.5	21.9	22.2	22.6	23.0	23.4	0.95
Burns Lake	25	16.7	19.4	19.7	19.9	20.1	20.4	20.6	21.0	21.3	21.7	22.0	22.4	0.90
Chetwynd	25	16.0	17.4	17.6	17.8	18.0	18.2	18.5	18.8	19.1	19.4	19.7	20.0	0.90
Chief Lake	25	22.9	23.2	23.5	23.8	24.1	24.4	24.7	25.2	25.6	26.0	26.5	26.9	0.98
Colebank	25	4.8	4.9	4.9	5.0	5.0	5.1	5.2	5.2	5.3	5.4	5.5	5.6	0.91
Dawson Creek	25	29.9	34.7	35.1	35.5	35.9	36.4	36.8	37.3	37.9	38.5	39.1	39.7	0.92
Firth Lake	25	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.91
Fort St. James	25	10.8	11.3	11.5	11.6	11.7	11.9	12.0	12.2	12.4	12.6	12.8	12.8	0.88
Fort St. John	25	45.3	49.5	50.1	50.7	51.3	51.9	52.6	53.4	54.3	55.1	56.0	56.9	0.94
Fraser Lake	25	4.8	5.5	5.5	5.6	5.7	5.7	5.8	5.9	6.0	6.1	6.2	6.3	0.90
Hendrix	7.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.93
Isle Pierre	25	3.1	3.8	3.9	3.9	4.0	4.0	4.1	4.1	4.2	4.3	4.3	4.4	0.90
Lac La Hache	25	1.5	1.6	1.6	1.6	1.6	1.6	1.7	1.7	1.7	1.7	1.8	1.8	0.90
Marguerite	12	2.3	2.3	2.3	2.4	2.4	2.4	2.5	2.5	2.6	2.6	2.6	2.7	0.88
McEwan	25	7.3	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.8	8.9	9.0	9.2	0.87
Morfee	25	10.4	11.7	11.9	12.0	12.2	12.3	12.5	12.7	12.9	13.1	13.3	13.5	0.92
Ospika	25	- - - - - - - - New Substation To Offload Patricia - - - - - - - - - -									10.5	10.5	10.5	
Patricia	12	73.5	80.0	81.0	82.0	83.1	84.2	85.3	86.8	88.4	79.5	81.2	82.8	0.95
Pineview	25	23.4	23.7	24.0	24.3	27.6	28.0	28.4	28.9	29.4	29.9	30.5	31.0	0.89
Portage Pass	12	2.3	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.8	2.8	2.9	2.9	0.93
Prince George	12	10.4	11.6	11.7	11.9	12.0	12.2	12.3	12.6	12.8	13.0	13.3	13.5	0.89
Prince George	25	8.7	9.6	9.8	9.9	7.0	7.1	7.2	7.3	7.5	7.6	7.7	7.9	0.92
Quesnel	12	26.7	27.0	27.4	27.7	28.0	28.4	28.7	29.2	29.6	30.1	30.6	31.1	0.91
Red Bluff	25	17.0	19.0	19.3	19.5	19.7	20.0	20.2	20.5	20.9	21.2	21.6	21.9	0.99
Tumbler Ridge	25	5.3	8.3	8.4	8.5	8.6	8.7	8.8	8.9	9.1	9.2	9.4	9.5	0.93
Upper Fraser	25	6.4	7.0	7.1	7.2	7.2	7.3	7.4	7.5	7.7	7.8	7.9	8.0	0.90
Vanderhoof	25	16.2	20.3	20.6	20.8	21.1	21.3	21.6	21.9	22.3	22.6	23.0	23.4	0.90
Williams Lake	12	24.5	19.5	19.8	20.2	20.5	20.9	21.2	21.7	22.2	- - To WLM 25 kV - - -			0.86
Williams Lake	25	36.1	38.9	39.4	39.8	40.3	40.8	41.2	41.9	42.5	65.9	67.1	68.3	0.97
Wright	12	1.5	1.5	1.5	1.5	1.6	1.6	1.6	1.6	1.7	1.7	1.7	1.7	0.90
100 Mile House	25	26.7	27.8	28.1	28.5	28.8	29.2	29.5	30.0	30.5	31.0	31.5	32.0	0.90
70 Mile House	25	3.7	3.8	3.8	3.9	3.9	4.0	4.0	4.1	4.1	4.2	4.3	4.4	0.90
76 Mile House	7.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1.00
Total		480.6	517.4	523.9	530.3	536.6	543.5	550.3	559.3	569.0	578.2	588.2	597.7	

NORTHERN DIVISION (CENTRAL INTERIOR)
INDUSTRIAL LOAD FORECAST
NON-COINCIDENT MV·A

Area Central Interior	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	Power Factor
Balfour Forest Ind. (Netherlands Overseas Mill)	7.1	7.1	7.1	7.1									0.99
B.C. Chemicals Ltd.	24.9	25.0	25.0	25.0									1.00
B.C.F.P. (McKenzie)	13.5	13.5	13.5	13.5									0.96
B.C. Rail Electrification	27.1	22.4	22.4	22.4									0.98
Canex Placer (Endako)	17.2	23.5	23.5	23.5									0.98
Cariboo Pulp & Paper	6.5	6.5	6.5	6.5									0.93
Denison Mines (Quintette)	34.2	33.7	33.7	33.7									0.86
Fibreco		61.9	61.9	61.9									0.97
Finlay Forest Ind. Ltd.	48.8	65.0	72.0	72.0									1.00
FMC (Prince George)				8.2									0.97
Gibralter Mines Ltd.	26.7	26.3	26.3	26.3									0.99
Gibralter - Pump	1.6	1.6	1.6	1.6									0.93
Husky Oil	5.0	5.4	5.4	5.4									0.92
Intercontinental Pulp	25.4	25.3	25.3	25.3									0.99
McLaren Bell Cooper	16.9	17.2	17.2	17.2									0.99
McLaren Boss Mtn.	0.2	0.3	0.3	0.3									1.00
Northwood Pulp (Prince George)	17.5	17.6	17.6	17.6									0.91
Petrocan (Taylor)	4.9	5.5	5.5	5.5									0.91
Pinette & Therrien		5.2	5.2	5.2									0.97
Prince George Pulp & Paper	34.1	33.7	33.7	33.7									0.98
Quesnel River Pulp & Paper	63.6	90.9	90.9	90.9									0.99
Takla Forest Products	6.5	6.5	6.5	6.5									0.92
Teck (Bullmoose)	8.6	8.2	9.3	9.3									0.97
Texaco (Ft. St. John)	5.0	5.0	5.0	5.0									1.00
Weldwood (Quesnel)	5.7	6.1	6.1	6.1									0.98
Weldwood (Williams Lake)	6.9	7.1	7.1	7.1									0.99
West Fraser (Fraser Lake)	6.6	6.1	6.1	6.1									0.99
West Fraser (Quesnel)	5.8	5.4	5.4	5.4									0.92
Westar (Plateau)	5.8	6.7	6.7	6.7									0.89
Westcoast Trans (Taylor)	20.8	20.9	20.9	20.9									0.91
C.I. Existing Industrial Load					576.9	560.8	562.8	567.1	541.8	545.8	547.9	550.9	
C.I. Future Industrial Load									51.5	84.5	84.5	84.5	
Total	446.9	559.6	567.7	575.9	576.9	560.8	562.8	567.1	593.3	630.3	632.4	635.4	

SOUTH INTERIOR DIVISION (WEST)
SUBSTATION LOAD FORECAST
NON-COINCIDENT MV·A

Area South Interior - West	kV	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	Power Factor
Armstrong	25	22.1	23.5	23.8	24.2	24.5	24.9	25.3	25.7	26.0	26.4	26.8	27.2	0.89
Ashcroft	25	9.5	9.7	9.9	10.1	10.3	10.4	10.6	10.7	10.9	11.0	11.2	11.4	0.95
Avola	14.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.95
Barriere	25	9.6	9.8	10.5	10.7	10.9	11.1	11.3	11.5	11.8	12.0	12.2	12.5	0.82
Blue River	25	1.6	1.6	1.6	1.7	1.7	1.7	1.7	1.8	1.8	1.8	1.9	1.9	0.95
Bralorne	2.4	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.95
Bridge River	12	1.4	1.4	1.4	1.5	1.5	1.5	1.5	1.6	1.6	1.6	1.6	1.6	0.95
Brocklehurst	25	44.9	45.6	46.3	47.0	47.7	48.4	49.4	50.4	51.4	52.4	53.4	54.5	0.99
Canoe	12	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	0.95
Chase	25	5.7	5.7	5.8	5.9	6.0	6.1	6.2	6.3	6.4	6.5	6.6	6.7	0.95
Clearwater	25	7.9	8.1	8.2	8.3	8.4	8.5	8.7	8.8	8.9	9.1	9.2	9.3	0.88
Clinton	25	2.4	2.4	2.5	2.5	2.5	2.5	2.6	2.6	2.6	2.7	2.7	2.7	0.95
Douglas Street	12	4.2	- - -

SOUTH INTERIOR DIVISION (EAST)
SUBSTATION LOAD FORECAST
NON-COINCIDENT MV·A

Area South Interior - East	kV	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	Power Factor
Aberfeldie	12	1.0	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.2	1.2	0.95
Athalmer	25	25.9	26.4	26.9	27.4	21.8	22.2	22.7	23.1	23.6	24.1	24.5	25.0	0.94
Canal Flats	12	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	0.95
Cranbrook City	4	4.9	3.7	3.7	3.7	3.8	3.8	3.8	3.9	3.9	4.0	4.0	4.0	0.95
Elkford	25	3.8	3.8	3.8	3.8	3.8	3.9	3.9	3.9	4.0	4.0	4.1	4.1	0.95
Fairmont	12	1.1	1.1	1.2	1.2	1.2	1.3	1.3	1.3	1.3	1.4	1.4	1.4	0.96
Fairmont	25	3.5	3.6	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.2	4.3	4.4	0.96
Fernie	4	3.0	2.7	2.7	2.7	2.8	2.8	2.8	2.9	2.9	2.9	2.9	3.0	0.95
Fernie	25	6.3	7.2	7.3	7.4	7.4	7.5	7.6	7.7	7.7	7.8	7.9	8.0	0.95
Fort Steele	12	1.7	1.8	1.8	1.8	1.9	1.9	1.9	1.9	1.9	2.0	2.0	2.0	0.95
Golden	12	5.5	5.6	5.7	5.8	5.9	6.0	6.1	6.3	6.4	6.5	6.6	6.8	0.95
Golden	25	11.1	11.4	11.6	11.8	12.1	12.3	12.6	12.8	13.1	13.3	13.6	13.9	0.95
Invermere	25					6.2	6.3	6.5	6.6	6.7	6.9	7.0	7.1	0.95
Joseph Creek	25	21.8	23.3	23.5	23.9	24.2	24.6	25.0	25.3	25.7	26.1	26.5	26.9	0.95
Kimberley	4	4.5	- - -

SOUTH INTERIOR DIVISION
INDUSTRIAL LOAD FORECAST
NON-COINCIDENT MV·A

Area South Interior	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	Power Factor
Afton Mines Ltd. (Kamloops)	13.8	14.1	14.1	14.1									0.99
Alberta Natural Gas (Crowsnest)	0.5	0.6	0.6	0.6									0.97
Bethlehem Copper													0.97
Brenda Mines Ltd.	28.9	28.6	28.6	28.6									0.98
Byron Creek Coal	7.2	7.4	7.4	7.4									0.95
Cache Creek Woodchips		3.2	3.2	3.2									0.95
Cdn. Cement LaFarge (Kamloops)		4.2	4.2	4.2									0.96
Crestbrook (Canal Flats)	4.5	4.5	4.5	4.5									0.88
Crestbrook (Elko)	4.7	4.6	4.6	4.6									0.87
Crestbrook (Skookumchuck)	9.3	9.3	9.3	9.3									0.97
Crowsnest Res. (Line Creek)	9.2	9.7	9.7	9.7									0.93
Fording Coal	21.9	23.5	23.5	23.5									0.98
Highland Valley Copper	107.9	121.0	136.0	138.0									1.00
Highmont Mines Ltd. (Ashcroft)	3.4	1.1											0.93
Lornex Mining Corp.													0.97
Lornex Mining Corp. LL Dam													0.97
McLaren Goldstream	0.4	0.5	0.5	0.5									0.99
Newmont Mines Ltd.	37.7	37.8	37.8	37.8									0.98
Steel Bros. (Pavilion)	1.7	1.7	1.7	1.7									0.89
Trans Mtn. Pipeline (Albreda)			2.0	2.0									0.90
Trans Mtn. Pipeline (Darfield)			2.0	2.0									0.90
Trans Mtn. Pipeline (Kamloops)	6.7	6.5	6.5	7.5									0.93
Trans Mtn. Pipeline (McMurphy)	1.9	2.0	2.0	2.0									0.95
Westar (Balmer)	27.9	28.3	28.3	28.3									0.92
Westar (Greenhills)	10.1	10.1	10.1	10.1									0.99
Weyerhauser Canada Co.	20.7	20.2	20.2	20.2									0.99
S.I. Existing Industrial Load					333.2	337.4	339.4	342.5	345.5	347.5	300.9	302.9	
S.I. Future Industrial Load								15.5	22.7	22.7	22.7	63.9	
Total	318.4	338.9	356.8	359.8	333.2	337.4	339.4	358.0	368.2	370.2	323.6	366.8	